DERCUM (F. X.)

RAILWAY SHOCK

AND

ITS TREATMENT.

BY

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M R. PRESIDENT AND GENTLE-
MEN :—In making a choice of sub-
ject I was guided mainly by the consideration
that an address before a body of medical men
actively engaged in practice should be emi-
nently practical in nature. Ere I have fin-
ished I think that you will agree with me
that the subject of railway shock is one
fraught with many practical questions, some
of which bear an intimate relation to the
routine of our daily lives, and which are im-
portant not so much because of the frequency
of railway shock, but because of the valuable
lessons which they teach. The theoretical
aspects of the subject I shall be obliged to
consider to some extent, but I propose doing
so as briefly as the clear understanding of it
will permit.

To many, doubtless, on first seeing the an-
nouncement of the title of this paper, " Rail-
way Shock," the thought occurred that shock
from railway injuries cannot differ in any es-

sential point from shock produced by other causes. You will find, however, that the causation of railway shock is peculiar,—that its causation is composite, and that, therefore, the resulting condition presents special features. Certainly railway shock differs from ordinary traumatic shock, from surgical shock, and from purely emotional shock, and there is abundant justification for the use of the term.

Before proceeding, let us endeavor to obtain clear notions of shock itself. What is shock ? What is its pathology ?

Let us recall, to begin with, the classical experiment of Goltz. You will remember that he took a frog, placed him in an erect or vertical position, and then exposed the heart so that its pulsations could be readily studied. He then struck the abdomen a severe blow. Instantly the heart ceased beating, and only after a while did it resume its pulsations. The latter, too, were much weaker than before. Evidently the impression, the shock of the blow, had been transmitted to the nerve-centres, and thence, acting upon the heart, had caused it to become suddenly arrested and also for a time much weakened. Physiologists, as you know, express this phenomenon as one of reflex inhibition ; but in whatever terms we state it, the cardinal point for us to recognize is, that it is one of sudden *cardiac paresis*.

The behavior of the heart, however, was not the only thing observed by Goltz. He noticed in addition that the blood, which had but a moment before distended the heart and vena cava, was gravitating into the abdominal

veins, leaving the heart and its vessels practically empty. Evidently the same impression that had caused diastolic arrest of the heart had here caused paralysis of the walls of the abdominal veins, or rather of the vaso-motor system of nerves that control them; and we are now led to suspect that a general paralysis of the entire vascular apparatus is what really obtains in this form of shock. Indeed, among other things, this view receives ample confirmation from the elaborate sphygmographic studies of the pulse made in cases of shock by Furneaux Jordan,* the tension in the arteries being invariably very low. Again, it is extremely probable that even the capillaries are involved in this paralysis, for John Hunter† observed in a lady, whom he was bleeding, and who fainted during the operation,—and fainting is a kind of shock,—that the blood flowing from the vein, " instead of being dark and venous, was of a bright scarlet color, like that of arterial blood," a phenomenon which could only obtain provided the capillaries were much dilated.

Let us pause a moment and ponder upon the generalization we have just reached. The most salient feature of shock from a blow upon the abdomen is a general vascular paralysis. Evidently this means that the great vaso-motor nerve-centres have been paralyzed, and certainly it is in the highest degree unphilosophical to suppose that the effect of

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* Furneaux Jordan, "Hastings Essay on Shock, Surgical Enquiries." London, 1880.

† Cited by Lauder Brunton, "Shock and Syncope," p. 13.

the blow is limited exclusively to these cen-
tres, or to attempt to explain all of the symp-
toms of shock by the mere vascular paralysis.
It is known, indeed, as an absolute fact, that
strong peripheral impressions will cause an
abeyance of all the functions of the cord.
S. Weir Mitchell has placed beyond all cavil
the facts of paralysis from peripheral irrita-
tion,* and in dwelling upon the explanation
of these strange phenomena, he quotes at
length the conclusions of Morehouse, Keen,
and himself, from which I extract the follow-
ing pregnant sentences : " Either the shock
of a wound destroys directly the vital power
of a nerve-centre, or it causes paralysis of the
vaso-motor nerves of the centre, with conse-
quent congestions and alterations. *But there
is no reason why, if shock be competent to de-
stroy vitality in vaso-motor nerves or centres, it
should be incompetent so to affect the centres of
motion or sensation.*"† Again, in speaking of
various effects, quite common, the results of
gunshot wounds, he says,‡ " These have been
more or less vaguely treated of as shock,
commotion, stupor, etc. The larger part of
those who receive flesh wounds, involving no
important organ, are but little affected at the
time, or may even be unconscious of having
been hit, and exhibit no well-marked imme-
diate constitutional disturbance.

" In other cases, and particularly in wounds

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* S. Weir Mitchell, " Paralysis from Peripheral Irri-
tation" (*New York Medical Journal*, 1866, vol. ii. pp.
321 and 401).

† *Loc. cit.*, p. 353. Italics in the original.

‡ *Loc. cit.*, pp. 403 and 404.

of graver nature, the patient instantly falls senseless, and so remains during a few minutes, or many hours, when he revives again, either completely, or to suffer from a continued state of depression known as the shock, and marked by the usual features of great weakness, feeble circulation, pallor, etc.

" In other cases the last-named symptoms come on at once and without the intervention or accompaniment of unconsciousness.

" These very interesting states of the system may be due, it seems to us, either to an arrest or enfeeblement of the heart's action through the mediation of the medulla oblongata and the pneumogastric nerves, or to a general functional paralysis of the nerve-centres, both spinal and cerebral, or, finally, to a combination of both."

Again, he says, " A severe injury, as a gunshot wound of a limb or the neck, may produce its effects of unconsciousness and loss of power, by greatly weakening, or for a time destroying, with various degrees of completeness, the functions of all the nerve-centres and of their conducting cords." A little farther on occurs this significant paragraph : " The majority of physicians will, no doubt, be disposed to attribute the chief share in the phenomena of shock, in its various forms, to the indirect influence exerted upon and through the heart. There are, however, certain facts which, duly considered, will, we think, lead us to suppose that in many cases the phenomena in question may be due to a temporary paralysis of the whole range of nerve-centres, and that among these phenomena the cardiac feebleness may play a large

part, and be itself induced by the state of the regulating nerve-centres of the great circulatory organ."

Mansell-Moullin, also, recognizes the general involvement of the nervous system, for he tells us that " shock is an example of reflex paralysis in the strictest and narrowest sense of the term,—a reflex inhibition, probably in the majority of cases general, affecting all the functions of the nervous system, and not limited to the heart and vessels only."* The word inhibition, however, mars this otherwise excellent definition. It implies that the various functions of the nervous system are suppressed or held in abeyance by some active agency, whereas the condition is, doubtless, one of simple loss of function, the result of violent molecular jar. To use a well-worn comparison, it is a loss of function similar to the loss of power in a magnet when the latter has been struck a violent blow. Not that I desire to give the impression that the nervous system must necessarily receive a violent mechanical jar, but merely a sudden profound and exhausting impression, whether the latter be a blow upon the stomach, the crushing of a limb, the wound of a nerve, or merely a violent mental shock.

Further, Groeningen† points out in the most conclusive manner that the vascular phenomena alone are utterly incapable of explaining the symptoms of shock, and at-

* Mansell-Moullin on " Shock" in " International Encyclopædia of Surgery," vol. i. p. 369, 1881.

† Groeningen, " Ueber den Shock." Wiesbaden, 1885.

taches himself, with some minor reservations, to the theory of Leyden,* "that a powerful irritation, whether it impresses the cord directly, or indirectly through the mediation of a peripheral sensory nerve, provokes in it powerful (molecular) movements of the nerve-mass, and renders the same insensitive to the transmission of less intense excitations." Leyden includes in the resulting disturbances of function not only those of motility and sensibility, but also the action on the heart, on the vaso-motor nerves, and on the respiration. Groeningen, however, defines shock as "a fatigue or exhaustion of the spinal cord and medulla oblongata caused by a powerful sudden impression (insult)."† This restriction of the field of shock-action to the cord and medulla appears to us to be most unphilosophical and entirely unwarranted. To what, for instance, is the paresis of the will, the general and profound mental anenergia, to be attributed if not to a participation by the cerebrum? Again, what becomes of the cases of shock due to mental influences alone, not to speak of shock (concussion) due to actual blows upon the head? Is it because the cardiac and vascular phenomena, the temperature phenomena, may be less marked in these latter instances, that they are to be excluded? If so, what becomes of the undoubted cases of *railway* shock,—a form of shock in which mental action plays so prominent a part? Surely, if the cord and medulla be capable of undergoing a suspension of

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* Cited by Groeningen, *loc. cit.*, p. 45.
† *Loc. cit.*, p. 69.

function, due to violent molecular move-
ments, the same must be true of the brain;
true alike whether we have gross concussion
or simple sudden exhaustion due to mental
action alone. The fact that the various
forms of cerebral shock—shock from emotion,
shock from coarse vibratory jar, shock from
actual trauma—form such widely different
clinical pictures, cannot weigh against the
truth of this proposition. That shock, having
its point of departure, its focus of distribution,
in the brain, should present special symptoms,
must be expected on *a priori* grounds, and,
further, that the symptoms should vary with
the character of the impression also follows
of necessity. It would be equally impossible
to draw a distinction between the shock of
the cord by a blow upon the abdomen or the
concussion of the cord due to the impact of a
bullet upon the vertebral column. The symp-
tomatology is different in large part, but the
principle is intrinsically the same. (See Ley-
den's view.)

Thus far, then, we have every reason to re-
gard the symptoms of shock as referable to
the nervous system as a whole. Further, we
should expect on *a priori* grounds that cer-
tain symptoms, or groups of symptoms, should
predominate, according to the part of the body
by which the injury is received, and this, in
a general sense, we find to be the case.
For example, in shock from a blow upon the
abdomen, vascular phenomena predominate ;
in shock from a blow upon the lumbar cord,
spinal symptoms predominate (although vas-
cular symptoms are also present) ; and in
shock from a blow upon the head, of course,

brain symptoms predominate. That shock of
the cord does occur is known to every experi-
mental physiologist, while the cases of Erb,*
of Hunt,† that of Jordan,‡ and one lately
placed on record by myself,§ show that it
actually occurs in man.

Again, while the symptoms of shock are
thus modified, according to the part by
which the injury has been received, we must
remember that it may be of all degrees of
intensity, and that, therefore, individual cases
injured in a similar manner may differ clin-
ically. Further, the symptoms may be very
much modified by the emotional state of the
patient at the time of the injury. This fact
and its importance we will presently realize.
Again, as was pointed out by Jordan,‖ age
is a modifying factor in shock. Children,
other things equal, are less readily shocked
than the middle-aged or the old. Lastly, the
temperament of the individual, as has been
recognized by all writers, exerts a powerful
influence in determining not only the symp-
toms but also the occurrence of shock.

Let us now, in order that we may fully
understand the subject, carefully rehearse
the symptoms of simple severe shock. Let
us take a case in which a powerful blow has
been received, and let us suppose that the

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* Erb, " Ziemssen's Encyclopædia," American trans-
lation, vol. xiii. p. 349 *et seq.*

† Hunt, " Pepper's System," vol. v. p. 913.

‡ Jordan, *loc. cit.*, p. 39.

§ Dercum, " Remarks on Spinal Injuries" (THERA-
PEUTIC GAZETTE, May 15, 1889).

‖ Jordan, *loc. cit.*, p. 30.

case has been observed *very shortly* after the occurrence of the accident.

We have, to begin with, profound, muscular weakness ; secondly, a feeble, shallow respiration ; thirdly, a feeble, slow, soft, almost imperceptible pulse ; fourthly, great pallor of the surface ; fifthly, great coldness of the surface ; sixthly, a cold, clammy sweat. Examination further discloses that the sensibilities, both general and special, are blunted ; that the will is weakened, if not altogether in abeyance ; for the patient can only be stimulated to exert himself by repeated urging. In short, the whole picture is one typical of extreme depression.

I cannot do better, perhaps, in order to vividly recall this picture, than to cite the classical description of a case by Fischer:* "The patient, a strong and perfectly healthy young man, was struck in the abdomen by the pole of a carriage drawn by runaway horses. No serious injury was done to any of the internal organs, at least we have not been able, after a careful examination, to find any trace of one. Nevertheless, the grave symptoms and the alarming look, which he still presents, made their appearance immediately after the accident. He lies, as we see, perfectly quiet, and pays no attention whatever to anything going on around him. His countenance is sunk and peculiarly elongated, his forehead is wrinkled, and his nostrils dilated. His weary, lustreless eyes are deeply sunk in their sockets, half covered by his drooping eyelids and sur-

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* Cited by Lauder Brunton, *loc. cit.*, p. 3.

rounded by broad dark rings. The pupils are dilated and react slowly to light. He stares, purposelessly and apathetically, straight before him. His skin, and such parts of the mucous membranes as are visible, are pale as marble, and his hands and lips have a bluish tinge. Large drops of sweat hang on his forehead and eyebrows. His whole body feels cold to the hand, and a diminution of temperature is readily detected by the thermometer, which indicates a degree and a half in the axilla and a degree Centigrade in the rectum below normal. Sensibility is much blunted over the whole body, and only when a very painful impression is made on the patient does he fretfully pull a wry face and make a languid, defensive movement. He does not move a single limb spontaneously ; but, after being repeatedly and urgently requested, he shows that he can still execute limited and brief movements with his extremities. If the limbs are lifted and then let go, they immediately fall as if dead. . . . . The pulse is almost imperceptible, irregular, unequal, and very rapid. The arteries are small and the tension very low. While the patient was being brought to the hospital, the pulse became quite imperceptible, and the cardiac sounds very irregular and intermittent. The patient is perfectly conscious : he replies very slowly and only when repeatedly and importunately questioned, but his answers are quite to the point. . . . He gave the details of the accident reluctantly and imperfectly, but in the main correctly. Only while he was being brought to the hospital did he refuse to answer at all. His voice is hoarse and weak,

but his articulation is good. . . . His senses
are perfectly acute. His respiration appears
to be irregular, and abnormally long, deep,
and sighing inspirations alternate with very
superficial ones, which are scarcely visible or
audible. While being brought to the hospital
he vomited several times, and nausea and
hiccough still remain. Any one who knew
the patient, or had seen him shortly before
the accident, could hardly recognize him now.
His appearance, cold skin, and hoarse voice
immediately recall the appearance of a cholera
patient to the memory of the attentive ob-
server; the characteristic dejections are
alone wanting to make the resemblance com-
plete."

In this graphic account you may notice
that the pulse is spoken of as very rapid,
while in the summary of symptoms I first
gave it is mentioned as slow. That the
pulse is probably always slow, as an immedi-
ate result of the accident, is shown by the
observations of Jordan,* who, on making a
special examination of the heart's action in
forty-seven cases of shock from various
causes, found it to be invariably slow. Jor-
dan interprets the rapid pulse as a pulse of
reaction. In this he is followed by most
writers. By far the majority of cases of
shock which we see are cases in which re-
action has already begun, and in them we
find, or are apt to find, a rapid pulse.

You will notice, also, that the senses,
doubtless meaning the special senses, are

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* *Loc. cit.*, p. 45.

spoken of as acute, while in our summary they are spoken of as dulled. It is very probable that this occasional sharpening of the special senses is also a symptom of re-action. This brings us to the discussion of the so-called erethistic form of shock.

Long ago Travers* distinguished from the form of shock we have been considering an-other, which he termed prostration with ex-citement, and which later writers have termed the erethistic form. Instead of lying abso-lutely quiet in the position in which they have accidentally fallen or been placed, the patients toss about wildly, complain loudly, say that they cannot breathe, act as though suffering the greatest agony, and frequently express their fear of impending death. They pay no attention to what is going on around them, being entirely taken up by their own suffer-ing. Sometimes they are actively delirious. Their muscles tremble, and the breathing is rapid and short, now and then a deeper in-spiration occurring. The pulse is rapid and soft. Instead of great pallor of the surface, the face is flushed, and the skin, instead of being cold and clammy, is at first hot and dry. But see what happens. "As the ex-haustion increases the skin becomes covered with cold and clammy sweat, which is often very profuse. The face becomes pale and the expression haggard, the pulse innumer-ably rapid, irregular, fluttering ; subsultus comes on ; slight convulsions ; coma more or

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* Travers, on "Constitutional Irritation." London, 1827.

less profound ; and (it may be) death."*
Evidently, then, the so-called erethistic form
is at times only a precursor of the ordinary
torpid form ; and, as Lauder Brunton points
out, " Patients recovering from the torpid
form may come gradually to present the
symptoms of the erethistic form."† Without
discussing the matter further, I am inclined
to look upon the erethistic form as either a
preliminary stage, or incomplete stage, of
simple shock ; or it is to be regarded as a
stage of imperfect reaction from simple shock.
I think with Groeningen, therefore, that this
so-called erethistic shock is not to be consid-
ered as a separate form.

Having now formed a conception of shock
in general, let us turn our attention to rail-
road shock in particular. Jordan, in speak-
ing of general shock, recognizes four causes :‡

" 1. Those which act on the corporeal or-
ganization.

" 2. Those which act on the psychical
functions.

" 3. Those which act on both the corporeal
and the psychical functions in equal or un-
equal degrees."

4. Cold.

Without stopping to criticise the fourth
cause, which, it seems to us, really belongs
to the first,—namely, causes " which act on
the corporeal elements,"—let us see under
what head the causes of railroad shock are to
be sought.

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* Savory, on " Collapse" (Holmes's " System of Sur-
gery," vol. i. p. 378).

† *Loc. cit.*, p. 6.   ‡ *Loc. cit.*, p. 8.

A moment's reflection will convince us that the causes of railway shock may be found under any of the first three of Jordan's divisions.

A railway accident may ensue in such a way that the subject of it receives a violent trauma, with instantaneous loss of consciousness, and the shock, then, is the result purely of the corporeal impression. Secondly, it may occur in such a way that the subject receives no physical injury whatever, but merely suffers from an intense psychic impression. Thirdly, the subject may suffer from a combination of both these causes ; and this includes, indeed, the vast majority of cases of railway shock. Jordan tells us that " the principal feature in railway injuries is the combination of the psychical and corporeal elements in the causation of shock, in such a manner that the former, or psychical element, is always present in its most intense and violent form. The incidents of a railway accident contribute to form a combination of the most terrible circumstances which it is possible for the mind to conceive. The vastness of the destructive forces, the magnitude of the results, the imminent danger to the lives of numbers of human beings, and the hopelessness of escape from the danger give rise to emotions which in themselves are quite sufficient to produce shock, or even death itself. Syncope, or concussion of the brain, may destroy consciousness for a time, or possibly altogether ; but if consciousness return, depressing influences still operate, although less injuriously, but on a blunted nerve-power. All that the most

powerful impression on the nervous system can effect is effected in a railway accident, and this quite irrespectively of the extent or importance of the bodily injury. Indeed, if there be no bodily injury whatever, the shock may, nevertheless, be intense, and be followed by ulterior results, the nature and mode of termination of which it may be difficult to foresee. With the fullest extent of mental shock, the extent of bodily injury may vary greatly, from an abrasion of the skin to the crushing of the body into a shapeless mass."*

We can fully understand, then, that sequelæ of the most persistent and distressing kind should result from railway shock. The sudden, excessive, exhausting discharge of nervous energy in the excitement, the fright, the horror of the moment, must certainly result in a general weakness more or less marked, more or less enduring. That such a condition does result is a matter of daily clinical experience. It was fully recognized by Jordan, who termed it chronic shock or chronic asthenia, while later writers have termed it traumatic neurasthenia.

If we add to this the fact that in railway accidents the trunk and head are particularly liable to injury, that the body, as a whole, is apt to be "thrown violently into contact with surrounding objects," and that brain or cord symptoms are correspondingly present, we are at length in a position to appreciate what is meant by "railway shock;" and the subject assumes still deeper significance when we are

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* *Loc. cit.*, p. 37.

brought face to face with the fact that degenerative processes, actual organic changes, may occur in the nervous centres themselves.

Recognizing, then, that railway shock is made up of two elements,—physical and psychic,—we can readily understand that in any given case the symptoms will vary according as the one cause or the other predominates. As Page and other writers before him have pointed out, shock from purely mechanical injury, such, for instance, as the crushing of a limb, is relatively short, and not, as a rule, followed by symptoms of general nervous disturbance, while shock from purely psychic causes is usually very persistent. Page* says, "It is a seemingly anomalous and most noteworthy fact that the collapse which in these railway accidents accompanies serious bodily injury, such as severe laceration of limb or fracture of bones,—always excepting the collapse from severe concussion of the brain,—is not followed, or is, indeed, very rarely followed, by the train of after-symptoms indicative of general nervous shock. This is a fact of the greatest interest and importance, and one which will help to throw light upon those symptoms of general nervous shock which are so often seen after the slighter degrees of initial collapse." As an example of the persistence and the kinds

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* Page, "Injuries to the Spine and Spinal Cord." London, 1883, p. 150. That this does not always hold good is shown by two cases reported by Knapp, "Nervous Affections following Injury" (*Boston Medical and Surgical Journal*, November 1 and 8, 1888; Cases XI. and XII.).

of symptoms presented by cases in which the psychic cause largely predominates, Page cites* the case of a tall and powerful man, aged 46, who " was in a very severe and destructive collision. He received bruises over both arms and legs, and also a blow upon the face, which abraded the skin over and fractured the bones of the nose. He was not stunned. He lay for several days after the accident in a state of great nervous depression, with feeble and rapid pulse, and inability to eat or sleep. He suffered at the same time much distress from the fact that a friend, sitting beside him in the carriage, had been killed, and this seemed to prey constantly on his mind. The bodily injuries progressed rapidly towards recovery, and in seventeen days after the accident he was able to be moved home. Nine weeks after the accident he had fairly recovered from his injuries, and made no complaint of bodily sufferings. The ordinary functions of the body were natural, but his mental condition showed extreme emotional disturbance. He complained that he had suffered continuously from depression of spirits, as if some great trouble were impending. He feels very upset at our visit, and begins to cry. . . . His voice is very weak and indistinct, and occasionally, he says, it is almost inaudible. He sleeps very badly, waking frequently, and being constantly troubled by distressing dreams. His pulse is weak, 104. . . . Words, in fact, fail adequately to portray the distressing picture which this otherwise strong and healthy man

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* *Loc. cit.*, p. 151.

presented." Subsequently he underwent a slight and gradual improvement, but four years afterwards his medical attendant wrote that "his appearance was much altered, that he looked older, haggard, and that he had become very bald, that he was very depressed, sometimes had palpitation, loss of sleep, bad dreams, very easily tired, had lost all his energy, and was easily upset."

An interesting case of this form of shock was recently studied by myself. A gentleman, accompanied by his wife and child, started to spend a two weeks' vacation at one of the smaller resorts along the New Jersey coast, and to reach which it was necessary to change cars at a small way-station. The party alighted in safety on the platform of this station, which was raised a few feet above the level of the surrounding ground. It so happened that attached to the rear of the train were several freight-cars filled with railroad-ties, which laborers were unloading at various points along the road. During the stop made at this way-station a number of ties were likewise thrown off. One of them, however, had become so jammed into the body of the pile that the laborers, during the short time allowed, could not disengage it, and it was left jutting several feet beyond the side of the car. The train being started, this tie swept the platform on which our passengers had alighted, like a scythe. The husband, who was now at a little distance from his wife and child, was the first to perceive the danger. He cried out to his wife to lie down, while he himself jumped for his life. His wife obeyed, but as she did so she saw

her child, a little girl of 6, struck full in the abdomen and shockingly injured. She herself escaped all physical injury, but became at once uncontrollably excited and hysterical. She remained in this condition, with but little change, for three weeks, when, being three months pregnant, she miscarried. Subsequent to this she gradually improved, but she was evidently a very much changed woman. A year after the accident she was still very neurasthenic. From having been of a bright and cheerful disposition she became depressed and melancholic. Her color, too, was now habitually pale and of a very sallow tinge. She was exceedingly nervous, weak, and irritable, and utterly incapable of managing her household. Her pulse was weak and rapid, and her knee reflexes sluggish. Her back was painful, and superficial tenderness was discovered over the lumbar region. Her grip was decidedly tremulous. Regarding the miscarriage, it should be stated that though she had been a number of times pregnant, no miscarriage had ever occurred before. She had always, though of an admittedly nervous temperament, enjoyed good health.

Various instances might be cited, if time permitted, in which neurasthenia and hysteria, more or less marked, and even actual insanity, resulted from shock.

Page attempts to explain the marked difference between the sequelæ of shock from gross mechanical injury and shock from psychic causes by saying that in a case, for instance, of a broken leg, the patient has a definite injury on which his mind may dwell

and the progress towards recovery of which
he daily sees. Further, the enforced rest is
beneficial, and, the injury being definite,
"there is less likelihood of a dispute arising
as to compensation." That these considera-
tions are, however, not sufficient in them-
selves to explain, on the one hand, the ab-
sence or short duration of the symptoms of
nervous shock, or, on the other, their long-
continued existence, is vaguely recognized by
Page himself, for he even resorts to the re-
markable expedient of blaming bromide of
potassium for the protraction of the symp-
toms !

It may be that in the present state of our
knowledge no perfectly satisfactory explana-
tion can be given. However, may it not be
that in shock from severe bodily mutilation,
the very depth and intensity of the process
renders the nervous system insensitive to the
psychic impressions, just as a nerve, other
things equal, already exhausted by one stim-
ulus, is insensitive to others ? Remember
that a man whose limb or whose trunk is
crushed in a railway accident, is hurt, as a
rule, suddenly and unexpectedly,—*i.e.*, before
he has time to realize what is about to hap-
pen, or has happened,—and that the very re-
ception of his injury and the sudden on-
coming of collapse makes the additional
psychic shock impossible. Remember the
picture of extreme anenergy, both mental and
physical. Remember the torpor motor and
sensory, and you will realize that here the
additional factor of emotion can play no *rôle*.
Certainly this explanation is in harmony with
the facts. Why the sequelæ of psychic shock

should be so persistent does not concern us. It is simply the fact with which we have to deal.

Further, how serious and profound purely psychic shock may be is illustrated by a case related by Lauder Brunton, and which is so interesting that I may be pardoned for quoting it. " Many years ago the janitor of King's College, Aberdeen, had rendered himself in some way obnoxious to the students, and they determined to punish him. They accordingly procured a block and axe, which they conveyed to a lonely place, and, having dressed themselves in black, some of them prepared to act as judges, and sent others of their company to bring him before them. When he saw the preparations which had been made he at first affected to treat the whole thing as a joke, but was solemnly assured by the students that they meant it in real earnest. They proceeded to try him, found him guilty, and told him to prepare for immediate death, for they were going to behead him then and there. The trembling janitor looked all around, in the vain hope of seeing some indication that nothing was really meant, but stern looks everywhere met him, and one of the students proceeded to blindfold him. The poor man was made to kneel before the block, the executioner's axe was raised ; but, instead of the sharp edge, a wet towel was brought smartly down on the back of the culprit's neck. This was all the students meant to do, and, thinking that they had now frightened the janitor sufficiently, they undid the bandage which covered his eyes. To

their astonishment and horror, they found that he was dead."* Surely no mechanical shock ever killed more surely or more swiftly.

Another interesting case is related by Baunis.† A farmer, accompanied by a number of Arabs, had set out to kill a panther, which was making the farm insecure. Barely had he fired a shot before the panther leaped upon him and seized him in his claws. The bullets of the Arabs, however, immediately despatched the animal, and thus liberated the farmer. The latter was removed to the lazaret. Baunis discovered several scratches on the shoulder which might have been grasped by one of the animal's paws. The scratches were entirely superficial and had hardly bled. However, the patient was in a condition of deepest prostration. Face pale, skin cold. He was fully conscious, but was suffering from the indescribable impress of the fright he had received. Baunis in vain made use of stimulants and of moral persuasion; the next morning the unfortunate man was dead. At the autopsy no traumata whatever of the abdominal or thoracic cavities, nor of the central organs, were found. The injury of the shoulder proved to be entirely superficial, and had not involved the joint.

Paget‡ cites two fatal cases the result of railway collision, and they are especially interesting from the fact that death was delayed

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* Lauder Brunton, *loc. cit.*, p. 8.
† Cited by Groeningen, *loc. cit.*, p. 137.
‡ *Loc. cit.*, p. 168.

for several weeks. The first was that of "a man 40 years of age, of exceedingly delicate physique, who was in a collision at night. The accident was a slight one, and he was the only passenger injured. He was said, in the official report, to be 'violently shaken,' but he was able to go on home. The next day he was delirious, and on the third day he was still talking somewhat incoherently. He complained of being much shaken and feeling seriously injured, but there was no evidence discoverable of bodily hurt. He improved for a time, and his condition was not thought to be serious. He never seemed, however, to make any marked progress, and four weeks after the accident he became more prostrate, and greater anxiety was felt about him. From this time he gradually got weaker and weaker, and died on the thirty-seventh day. No organic disease whatever was found on post-mortem examination in any of the viscera.

The other case was that of "an apparently strong and healthy girl, 19 years of age, in good position in life, who was in a most serious collision. She received no bodily injury, but on the night of the accident she woke screaming that the engine was rushing into the room. Her illness followed much the same course, and she died in about five weeks, no structural disease whatever being found after death. The brain and spinal cord were examined in both instances."

Again, some years ago, there was brought to the nervous clinic of the University a child of 4 years, in which marked imbecility and permanent loss of speech had followed a

fright by a drunken man. Professor H. C
Wood is in the habit of relating to his class a
similar case, in which loss of speech and epi-
lepsy followed a protracted ride in a railway-
car, the child being the while in a perfect
paroxysm of terror. Cases such as these are
certainly very significant as indicating actual
organic changes as the result of psychic
shock.

Having now formed an idea of psychic
shock and its possible *rôle* in railway acci-
dents, let us turn our attention briefly to the
physical shock that may be received, and de-
termine whether the latter is always the tran-
sient affair that many writers would have us
believe. In many cases it is impossible to sepa-
rate the two elements of shock, and also to
estimate such complicating factors as loss of
blood. However, in the instance of simple
and uncomplicated direct shock (concussion)
of the cord, the symptoms can be readily
studied, and these cases we shall use as illus-
tration.

That the cord is actually the subject of
shock I need hardly repeat. Despite its deep
situation and despite its elaborate protection,
it is known to suffer severely from blows
upon the spinal column. That temporary
concussion of the cord—*i.e.*, transient arrest
of function—can occur is indubitably proved
by the cases of Hunt,* in one of which a bul-
let had lodged against a vertebra, but without
in any way injuring the spinal canal, and, in
the other, the cord had been shocked by a
fall upon the feet. In both cases the ensuing

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* *Loc. cit.*

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paraplegia was transient. The case reported by Jordan* proves that shock to the cord may in every way be as fatal as shock to the brain. The case was that of a man who had " discharged a pistol into his mouth and imdiately died. Examination of the body showed that the bullet struck the body of the second cervical vertebra ; but, beyond slight laceration of the tongue and of the upper part of the larynx and pharynx, no injury was done ; no vertebra or any other bone was broken. The naked eye could detect no change in the upper part of the cord or the membranes."

Further, that shock to the cord is *not always* a transient affair is shown by a case already placed on record by myself ;† and, secondly, that permanent changes in the cord occur as a result of spinal concussion is ably maintained by Gowers,‡ who, in addition to cases in which hemorrhage into the membranes, or into the substance of the cord, occurs, recognizes also those cases in which " no lesion of the cord has been found, either with the naked eye or the microscope, a few days after the injury." Further, he tells us, that " in other instances, in which the cord is examined some weeks or months after the accident, the signs of chronic myelitis are found, in scattered foci or more diffuse tracts, in the white columns or gray substance." He cites the case of a lady who was merely shaken in a railway

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* *Loc. cit.*

† Dercum, *loc. cit.*

‡ Gowers, " Diseases of the Nervous System." Philadelphia, 1888, pp. 435-437.

collision, who, in a few days developed para-
plegia, and in six weeks was dead, and in
whom a post-mortem examination revealed
"indications of subacute myelitis, chiefly in
the white columns, varying in its extent in
different regions, but in most parts consider-
able in the pyramidal tracts." Edes* also
records four cases of degeneration in the
postero-lateral columns of the cord, the result
of spinal concussion, and in one of these cases
determined the actual existence of the lesion
by an autopsy. Similar results were reached
by Duménil and Petil,† and Spitzka‡ also
states that shock and injury are among the
causal factors of both posterior and dissemi-
nated sclerosis. Other writers are also in
harmony with these views.

While some of the cases of organic disease
of the cord following blows upon the back are
due to intramedullary hemorrhage, and others
to small foci of inflammation, others still
appear to be due to a simple degenerative
process, just as though the vitality of various
tracts had been permanently affected by the
concussion.

We have considered thus far, though briefly,
the elements that enter into railway shock, as
well as some of the sequelæ. Let us now
turn our attention to treatment. What we

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* Edes, *Boston Medical and Surgical Journal,* Sep-
tember 21, 1882.

† Duménil et Petil, "Commotion de la Moell,
Épinière" (*Archives de Neurologie,* 1885, vol. ix. pp. 1,
145, 307).

‡ Spitzka, "Pepper's System," vol. v.

have thus far considered will now be found to have more or less practical significance.

The treatment of railway shock, as well as of shock in general, naturally falls into two subdivisions, — first, the treatment of the stage of shock itself ; and, secondly, the treatment of its sequelæ. In the treatment of the stage of shock itself two objects must be born in mind,—first, the averting of actual death and the production of a healthy reaction ; and, secondly, the averting, if possible, of either functional or organic sequelæ.

How, then, shall we treat a case of profound general shock ?

Let us remember that the symptoms of shock are essentially paralytic in their nature. Let us recall for a moment the feeble, almost imperceptible pulse, the feeble respiration, the cold, clammy surface, the extreme pallor, and the profound muscular weakness. The first thing that occurs to us is the use of a cardiac stimulant, and in all times alcohol has been used for this purpose. Whiskey, and preferably whiskey to which hot water has been added, is to be given, if possible ; but, it may be, either because the patient is vomiting, or by reason of the very depth of the shock itself, no decided effect is produced. Ammonia, in its various preparations, also suggests itself ; but, for like reasons, its effects may be inappreciable or altogether transient. A powerful remedy, however, we have in digitalis. Lauder Brunton* suggests its use in shock, basing his opinion upon the case of Wilks, in which shock followed labor,

* *Loc. cit.*, p. 17.

and in which recovery ensued on administering tincture of digitalis in ½-drachm doses every half-hour. That in digitalis we have a most valuable remedy there can be no doubt, and that in urgent cases it should be used in large doses, if at all, is equally true. It has the additional advantage of being readily administered subcutaneously, and, with proper care, can thus be given with great accuracy. Ten to twenty minims of the tincture, slightly diluted, can be injected at short intervals until some effect is noted upon the pulse. Further, atropine administered in the same way, in small doses and not too frequently repeated, may also be used to the same end, this drug being, as we know, a stimulant to the circulation, and notably to the vaso-motor centres.

However, we must remember that shock affects the nervous system as a whole, that not *one* system of centres but *all* are affected, and that, therefore, some remedy, more general in its action, should be employed. Such a remedy we have in strychnine. I have for some time past regarded strychnine as one of the remedies of the utmost importance in shock. Mansell-Moullin* and Groeningen† both recognize its value, especially the latter. Certainly, in profound shock—the shock that threatens to be fatal, shock that refuses to yield to other measures—strychnine should be given subcutaneously, and, if necessary, in massive doses. In extreme cases, I should not hesitate to use it in doses of $\frac{1}{10}$, or even $\frac{1}{5}$, of a grain. On *a priori* grounds alone,

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* *Loc. cit.*, p. 373. † *Loc. cit.*, p. 232.

the remedy must be regarded as of the utmost value, for by no other means can the nervous system be so profoundly impressed, so rapidly re-energized. It is strange, indeed, that it has been not more frequently resorted to.

While these thoughts are passing through our minds, we must not forget that our patient is cold, cold even unto death, and that artificial heat is one of the very first desiderata. This heat can be supplied by cans or bottles of hot water, or other heated objects. The best of these means, however, meet the indications but imperfectly. The late Dr. Hunter, of Philadelphia, suggested the use of hot baths, but even these threaten to exhaust the almost dying patient by the unavoidable handling. Recently, in a case of collapse, occurring in a child during the course of a pleurisy, and in which the temperature fell to 96.5°, I caused an ordinary hospital waterbed to be filled with hot water, and, having covered it with several layers of flannel blankets, placed my patient upon it. The result was gratifying in the highest degree, the temperature of the body soon rising to a little above normal.

Evidently this expedient meets every indication. Not only have we a large amount of heat applied to a very large surface of the body ; but, what is very important, it is *dry* heat. Certainly, by no other means can the temperature of the body be so readily influenced as by the *hot*-water-bed.

Further, there can be no doubt that sinapisms to the epigastrium, and large enemata of hot coffee, are also conducive to reaction.

The subcutaneous injection of ether is, like-wise, also beneficial, though, in the cases in which I have seen it used,—namely, collapse during abdominal operations,—it seemed to act rather as local irritant, and thus stimulating the heart in a reflex way.*

We must remember, above all things, that our patient must be kept in an absolutely horizontal position, with the head rather lower than the trunk, that he must not be moved about or lifted unnecessarily, and that all manipulations, except such as are absolutely necessary to determine the condition of the circulation, the respiration and the temperature must be avoided. Very rarely, indeed, attempts at artificial respiration may be justified, or friction of the limbs, the direction being always towards the trunk, may be admissible. In the main, however, our patient will be most benefited if let alone.

Regarding such measures as transfusion of blood, the course pursued must depend on in how great degree the symptoms are due to loss of blood alone ; but, at best, I consider this means as of questionable utility. As regards the opposite expedient,—that of blood-letting,—it needs but to be mentioned to be condemned, notwithstanding the recommendation of Savory to open the external jugular !†

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* There can be no doubt that in shock, as elsewhere, the inhalation of ether—*i.e.*, its cautious and sparing administration—acts very much as does alcohol, namely, as a stimulant. This is, I believe, in harmony with the experience of surgeons. Chloroform in shock is, of course, to be rigidly tabooed.

† *Loc. cit.*, p. 383.

Of the various measures, then, at our command for treating a case of shock, whiskey and dry heat should first be employed ; secondly, our case being at the outset very threatening, a full dose of strychnine should be given hypodermically,—say $\frac{1}{10}$ of a grain. Following this, digitalis and atropine may be used. Repetition must be guided by the deepening of the collapse.

In shock with restlessness and excitement —that is, the so-called erethistic form—there is a strong temptation to the use of sedatives. No one, however, fully cognizant of the true nature of this state, can shut his eyes to their danger. The bromides, for instance, in small doses, are inefficient ; in large doses, depressant. Chloral, on the other hand, may give us sleep, but it will be at the expense of still further weakening the heart. How is it, you ask, with opium? Travers, Savory, and Jordan each speak in favor of its use,—that is, with qualification. It is like a two-edged sword ; it may in one instance quiet our patient, produce a restful sleep, and in another may overpower his already weakened nerve-centres. If used at all, it should be used in small doses, administered hypodermically, and repeated, if at all, with caution. On the whole, I regard it as a remedy rather to be avoided than courted. Travers speaks favorably of hyoscyamine, as does also Savory, and certainly this drug deserves a more extended trial.

I believe, however, that in the erethistic form of shock, in addition to the various measures employed in simple shock, we have no more valuable remedy than musk. Un-

fortunately, it can only with difficulty be obtained, much of that dispensed in its name being practically inert. However, should the remedy be at our command, it should be freely administered, in doses say of 15 grains, and preferably by the rectum. Its action in soothing, quieting, and steadying the nervous system is undoubted. Should musk be inaccessible, valerian might be employed, in large doses, of course, in its stead, but with much less promise of success. Better still, hops, in the form of the fluid extract, a drachm or more, may be administered.

You are to remember, however, above all things, that, as in the simple form of shock, needless interference with the patient is to be avoided, and that it is better to err in doing too little than attempting too much.

The individual judgment of the physician must always guide him in the selection of his remedies in any given case. Rest alone will in some cases in due time be followed by reaction. In others, again, a dose of whiskey, or, possibly, whiskey to which a small dose of morphine has been added, will give the most gratifying results. In others, still, the depression may be so great that the prompt application of external heat, and the various other powerful remedies already detailed, may be required. No fixed rule can be given ; the indications must be met as they arise.

Let us suppose, now, that the stage of shock itself has been successfully combated. Let us suppose that our case has been one of railway shock in which the psychic element has played a prominent part, or that

it is one of those cases in which powerful blows have been received upon the trunk or upon the back. We will remember at once how frequently psychic shock is attended by persistent sequelæ, not to speak of those more rare cases in which death itself follows after a time. Further, we recall the fact that permanent spinal symptoms, actual organic cord changes, may follow blows upon the trunk. What, then, shall be done, what measures shall we adopt, to meet these possibilities?

Evidently the state of rest must be prolonged,—prolonged far beyond the apparent needs of the patient's condition. All the time we should be on the alert for symp-toms indicative of chronicity, and by all means in our power combat them. Surely the neurasthenia and the profound hysteria that occasionally ensue upon shock demand rest, and the sooner it is given them the better ; and, in those cases in which shock of the cord is suspected,—in which, it may be, organic changes have been set up,—absolute rest is likewise indispensable. In other words, I believe that every case of railway shock, if at all severe, should at once be submitted to a rest-cure based upon the Weir Mitchell method. In such cases, whether mental or spinal, absolute rest, isolation from friends, forced feeding, massage, and electricity should be the order of the day.

Even with these precautions cases in which the sequelæ are delayed would escape us ; but " better late than never" should be our motto, and the rest-cure should be adopted whenever the sequelæ are detected.

The benefit of a careful watch over rail-
way cases can be no better illustrated than
those in which subsequent vertebral disease
leads to paraplegia, and in which interfer-
ence at an early day may avert this unfortu-
nate result. This field, however, does not
belong to to-day's discussion, and I merely
mention it because it is not improbable that
organic cord-changes dependent upon shock
may be arrested, or at least delayed, by
active measures taken in time.

The further consideration of this important
subject, which can hardly be condensed into
a brief address, and which I feel I have dealt
with but imperfectly, I leave now to your-
selves.